



Section 3.1 General

High-Occupancy Vehicle (HOV) projects can be developed as part of new freeway construction, freeway reconstruction, restriping existing freeways, or a combination of these. Since the majority of HOV projects in California involve some form of retrofitting within the existing freeway right of way, this chapter will focus on a set of guidelines for the typical geometric configurations and procedures for reducing the geometric cross sections for HOV facilities.

In general, typical geometric design of HOV facilities conforms to the Highway Design Manual (HDM). Reducing the typical geometrics may be pursued only after every effort to conform to the HDM is unsuccessful and must be evaluated on a case-by-case basis, with safety the primary consideration. District designers are strongly encouraged to seek the advice and input from Headquarters' Traffic Liaisons and Headquarters' Design Coordinators as early as possible. This is encouraged particularly when the project proposes not to conform to HDM standards or this guide.

Justification for the use of anything less than typical geometrics must be well documented by a sound engineering analysis. Any deviation from these

recommendations should be discussed with the FHWA Transportation Engineer, Traffic Operations personnel, from the District and Headquarters, Headquarters' Traffic Liaisons and Headquarters' Design Coordinators. See Topic 82, Chapter 80 of the HDM.

HOV facilities separated by barriers or buffers can typically be applied on all types of geometric configurations. Right of way constraints, and other factors, however, sometimes preclude the separated option. Whether separated or contiguous, the operational differences among the various HOV geometric options are minor when they are compared to the differences between any HOV lane and a mixed-flow lane.

The operation of a HOV facility is closely linked to its design features and the traffic demands on the freeway corridor. Typical geometric configurations are shown in the following sections to illustrate situations most often encountered in California. Because existing freeway geometric sections and right of way availability vary from one location to the next, situations will arise for which none of the scenarios will apply. For those situations, the District designer should consult with Traffic Operations personnel, from the District and Headquarters, Headquarters' Traffic Liaisons and Headquarters' Design Coordinators for advice.

Designers are encouraged to review Deputy Directive DD-43, Appendix A-3, for the policy on HOV Systems and relevant responsibilities. Also, review internal Departmental Memorandum, dated December 11, 1995, Appendices A-4 and A-5, regarding the termination of the HOV lane into its own mixed-flow lane.

This chapter is intended to describe various HOV geometric configurations and the associated traffic characteristics experienced with each option. Existing conditions routinely challenge geometric uniformity; however, every effort should be made to provide consistency in geometrics, signs and markings within a contiguous region, particularly for the same route or for connecting routes.

Section 3.2 General Design Criteria

1. Horizontal Stopping Sight Distance

Stopping sight distance (SSD) shall conform to the HDM standards. Where conformance is not feasible due to median barriers, the height of the taillights of a vehicle can be used as one reason to justify approval of a design exception fact sheet to the standard SSD. An engineering analysis and an approved design exception fact sheet shall document use of anything less than the standard SSD detailed in the HDM. Increasing the height of an object may provide taillight SSD in all situations except crest vertical curves. However, an engineering analysis and an approved design exception fact sheet must document its use.

2. Decision Stopping Sight Distance

Decision stopping sight distance should be provided to the nose of all HOV drop ramps, flyovers, and freeway-to-freeway HOV direct connectors. See the HDM, Section 201.7.

3. Vertical Clearance

The required minimum vertical clearance for major structures on freeways and expressways is 5.1m. An engineering analysis and an approved design exception fact sheet must justify any reduction from 5.1m.

Sign structures shall have a vertical minimum clearance of 5.5m. See the HDM, Section 309.2.

4. Drainage

The drainage of narrow median widths on retrofit HOV facilities should be carefully evaluated in superelevated areas or where the pavement slopes toward the median. A water-carrying barrier, a slotted pipe or an approved alternate must be provided in these areas. The HOV lane should be designed to meet the drainage requirements for a 25-year design storm.

5. Structural Section

The structural section of HOV lanes on new facilities should be equal to that of the adjacent mixed-flow lane unless a greater thickness is required due to anticipated high bus usage.

The structural section for retrofit HOV lanes should be structurally adequate for ten years after construction when reconstruction is warranted. The surface material and cross slope should be the same as the existing lanes. However, when the widening is contiguous to Portland cement concrete (PCC) pavement, and a Pavement Management System (PMS) survey and field review indicate that PCC pavement will need rehabilitation in less than ten years, the widening should be done with asphalt concrete (AC). If the existing pavement requires immediate rehabilitation, the work should be included in the HOV facility project.

6. Lane Width

Three and six tenths meter (3.6m) lanes are typical. See the HDM, Section 301.1. Three and three tenths meter (3.3m) lanes may be acceptable if justified by an engineering analysis and an approved design exception fact sheet. However, the outside mixed-flow lane should remain at 3.6m unless truck volume is less than 3%. When adjacent to a wall or barrier, shoulder widths between 1.5m and 2.4m on mainline HOV facilities should be avoided except as spot locations.

7. Shoulder Width/Horizontal Clearance

Shoulder width shall conform to the standards specified in the HDM, Section 309.1 for compliance with horizontal clearance standards to fixed objects. Less than standard shoulder and horizontal clearance widths must be justified by an engineering analysis and an approved design exception fact sheet.

Section 3.3 Geometric Configurations

Geometrics for mainline HOV facility configurations can be divided into these categories:

- A. **Barrier-Separated**
- B. **Buffer-Separated**
- C. **Contiguous**

The following factors should be considered when determining which configuration is appropriate:

1. Existing Geometric Cross-Section

The majority of HOV projects are retrofitted within the existing right of way by re-striping or reconstruction. However, if right of way is economically and environmentally feasible and the project is not interim in nature, the HOV project should conform to the HDM standards.

2. Operations

Operational characteristics such as part-time versus full-time operation, reversible HOV lanes, contra-flow lanes and continuous or restricted ingress/egress are essential considerations in determining a suitable geometric configuration.

3. Enforcement

HOV-related violations such as occupancy and crossing buffers must be enforced to maintain the integrity of the lanes. The designer should consider providing enforcement opportunities as discussed in Chapter 6, “HOV Enforcement.”



Section 3.4 Barrier-Separated HOV Facilities

Barrier-Separated HOV facilities can be used for reversible or two-way operation. Two-way operation is the most desirable when space and cost considerations are not major concerns. Barrier-separated HOV facilities, whether two-way or reversible, offer operational advantages such as:

1. Ease of enforcement (violations can be enforced at the ingress/egress locations).
2. Ease of incident management.
3. Unimpeded HOV operation without interference from the mixed-flow lanes.
4. Lower violation rates.
5. High level of driver comfort.

A. Two-Way Barrier-Separated HOV Facilities

Geometric cross-sections for a two-way barrier separated HOV facility are shown in Figure 3.1 and an elevated HOV facility shown in Figure 3.3. The elevated option can be used when right of way is limited.

Elevated HOV facilities should be 7.8m or wider between barriers. The 7.8m width between barriers provides flexibility for future conversion to two 3.3m lanes with 0.6m shoulders.

B. Reversible Barrier-Separated HOV Facilities

A reversible barrier-separated HOV facility should be considered when the project is severely constrained by right of way and environmental considerations. In addition, it is essential that the traffic directional split (after allowing for traffic growth) be 65% or more in the

heavier direction of flow. Once implemented, conversion of a reversible operation to other modes can be extremely difficult. However, if the appropriate directional splits can be maintained, this option provides capacity in the needed direction with far less right of way than otherwise required by permanent two-way HOV configurations. A typical geometric cross-section for a barrier-separated, reversible HOV facility is shown in Figure 3.1.



Section 3.5 Buffer-Separated HOV Facilities

The Buffer-Separated HOV facility is set apart or separated from the mixed-flow lanes by a buffer of variable widths, generally 1.2m or less. Buffers 3.6m to 4.8m are occasionally used, particularly if used in conjunction with ingress/egress acceleration and deceleration lanes with potential conversion to additional traffic lanes. However, such wide buffers should only be used when there is adequate width to provide 3.0m or wider shoulders left of the HOV lane. Buffer widths between 1.2m to 3.6m should not be used. This will discourage the use of buffers as a refuge area. Compared to contiguous HOV facilities, buffered HOV facilities generally provide the motorists with a better level of service. This includes higher driver comfort, extra margin of safety through providing extra maneuvering room, and a lessening of the impact from incidents on adjoining HOV and mixed-flow lanes. The typical geometric cross-section for buffer-separated HOV facilities is shown in Figure 3.2.



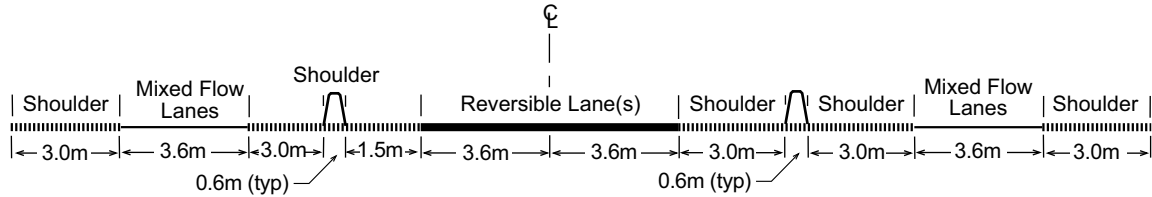
Section 3.6 Contiguous HOV Facilities

Contiguous HOV facilities are normally associated in areas with short duration, high volume peak commute traffic periods. Also, contiguous HOV facilities may be used when right of way limitations preclude buffer separation of the HOV lane from the mixed-flow traffic. Since the HOV traffic is free to enter and exit the lane throughout its length, no design details are required for ingress/egress except at the ends of the HOV facility.

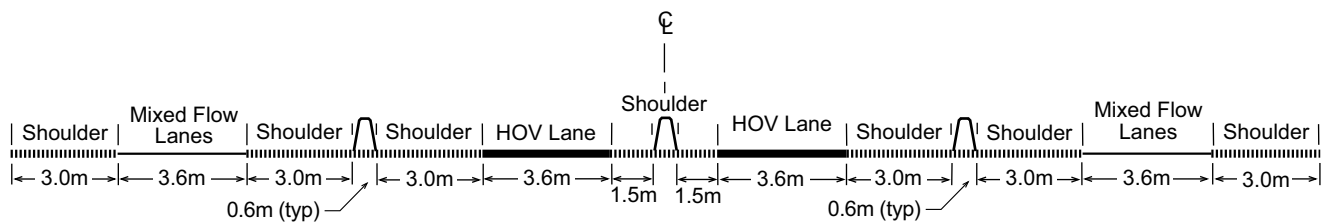
Part-time contiguous HOV facilities allow the use of all lanes during off-peak periods, particularly for construction and maintenance purposes. Additionally, part-time operation may be more acceptable to the motorist not totally convinced of the need for the HOV facility. Because the lane reverts to mixed-flow operation after the peak period, reductions from the typical geometrics need to be carefully analyzed. The typical geometric cross-section for a contiguous HOV facility is shown in Figure 3.2.

**FIGURE 3.1
TYPICAL CROSS SECTIONS
BARRIER-SEPARATED HOV FACILITIES**

NOT TO SCALE



**REVERSIBLE BARRIER-SEPARATED
HOV FACILITY**

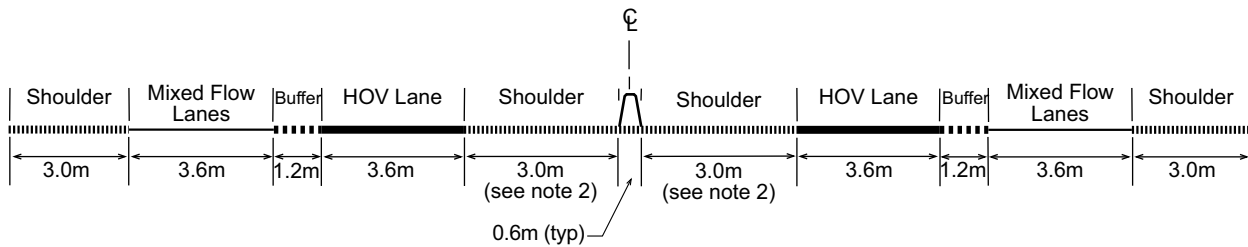


**TWO-WAY BARRIER-SEPARATED
HOV FACILITY**

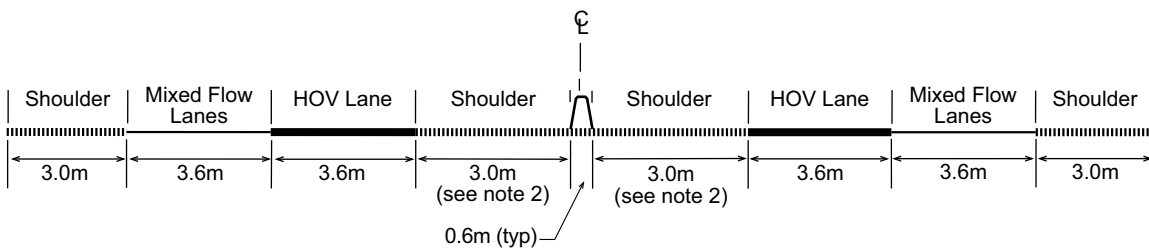
NOTE: Justification for the use of anything less than typical geometrics must be well documented by a sound engineering analysis. Any deviation from these recommendations should be discussed with the FHWA Transportation Engineer, Traffic Operations personnel, from the District and Headquarters, Headquarters' Traffic Liaisons and Headquarters' Design Coordinators. See Topic 82, Chapter 80 of the HDM.

**FIGURE 3.2
TYPICAL CROSS SECTIONS
BUFFER-SEPARATED AND CONTIGUOUS
HOV FACILITIES**

NOT TO SCALE



**BUFFER-SEPARATED
HOV FACILITY**



CONTIGUOUS HOV FACILITY

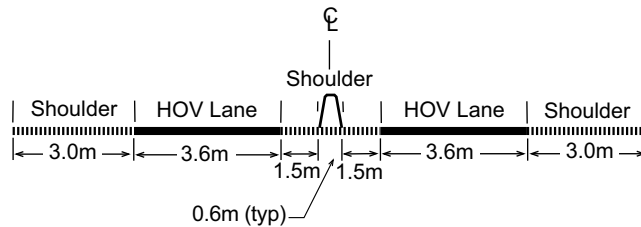
NOTE: 1. Justification for the use of anything less than typical geometrics must be well documented by a sound engineering analysis. Any deviation from these recommendations should be discussed with the FHWA Transportation Engineer, Traffic Operations personnel, from the District and Headquarters, Headquarters' Traffic Liaisons and Headquarters' Design Coordinators.
See Topic 82, Chapter 80 of the HDM.

2. Requires enforcement areas.
See Section 6.4, Chapter 6, Enforcement Alternatives.

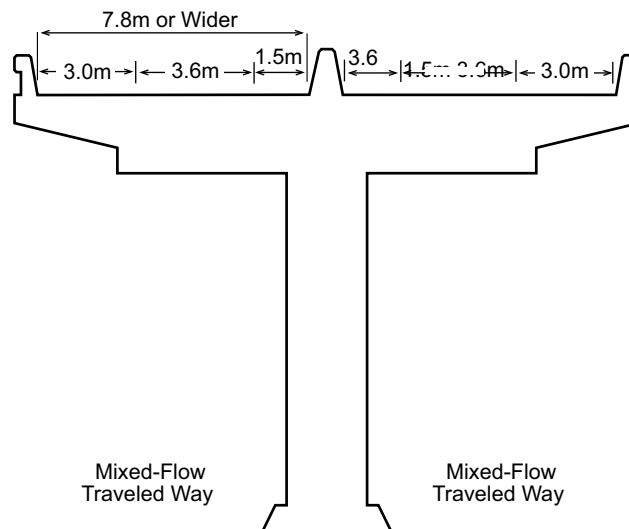


**FIGURE 3.3
TYPICAL CROSS SECTIONS
HOV DIRECT CONNECTOR
AND ELEVATED HOV FACILITIES**

NOT TO SCALE



HOV DIRECT CONNECTOR



ELEVATED HOV FACILITY

NOTE: 1. Justification for the use of anything less than typical geometrics must be well documented by a sound engineering analysis. Any deviation from these recommendations should be discussed with the FHWA Transportation Engineer, Traffic Operations personnel, from the District and Headquarters, Headquarters' Traffic Liaisons and Headquarters' Design Coordinators.
See Topic 82, Chapter 80 of the HDM.

2. All structure design details to be provided by the Engineering Service Center, Division of Structures, corresponding to Caltrans Standard Plans.



Section 3.7 HOV Direct Connectors

Continuing development in HOV design involves HOV direct connectors at intersecting freeways for seamless freeway to freeway movements. As this section is relatively new, operational and support data are becoming available for planning and designing HOV direct connectors. These guidelines will become more definitive as operational experiences accumulate.

The following factors, listed in random order, should be analyzed when HOV direct connectors are being considered. These factors are goals when planning and designing HOV direct connectors.

- | | |
|--|---|
| <p>A. Will the HOV direct connector provide HOV system continuity and will it be an integral element of the overall HOV system?</p> <p>B. Is forecasted HOV peak hour volume for the connector greater than 500 vehicles per hour per lane (vphpl) or 1100 persons per hour per lane (pphpl) within five years from opening? If not, will space be provided in the interchange to accommodate the eventual construction of HOV direct connectors?</p> <p>C. If the alternative to HOV direct connectors are weaving movements across mixed-flow traffic, will a weaving analysis show the development of a significant bottleneck, resulting in a net loss in overall time savings? If so, this situation may justify building HOV connectors, particularly if bus volume is high.</p> <p>D. Although HOV direct connectors should not be categorically rejected because of cost, will the cost/benefit analysis imply a reasonable rate of return? Anticipated benefits of HOV direct connectors are: (1) net travel-time savings and (2) safety benefits when compared to a ground level merging maneuver. Travel-time savings must consider potential increased delay for the mixed-flow traffic. Timesavings may be based on a “per passenger” basis rather than on the number of vehicles, (i.e. person-minutes rather than vehicle-minutes). Safety benefits for</p> | <p>HOV direct connectors are difficult to evaluate and should be discussed qualitatively until there is sufficient operational experience.</p> <p>E. Will the community accept the additional structural height, which may be necessary for HOV direct connectors?</p> <p>F. Is there a plan to maintain a desirable level of service for the HOV traffic by: (1) converting to a higher occupancy requirement or (2) providing an additional HOV lane to maintain a desirable level of service for the HOV traffic?</p> <p>G. Will it be fundable? HOV direct connectors are no more expensive than elevated HOV lanes and the need to provide continuity/connectivity may be equally cost effective as additional segments (miles) of HOV lanes, especially when user benefits are included. It is also important for Regional Transportation Planning Agencies (RTPA's) and Metropolitan Planning Organizations (MPO's) to recognize their value and plan for these important system components.</p> <p>H. With regard to the buffer-separated or barrier-separated HOV facility, would an additional ingress point be impractical due to the high cost of providing lateral space in the median?</p> <p>I. Will HOV direct connectors promote and enhance HOV usage or transit service in the region or corridor?</p> <p>J. Will HOV direct connectors eliminate or delay the need to reconstruct or add additional capacity or additional connectors to existing freeway-to-freeway interchanges?</p> <p>K. Will HOV direct connectors substantially improve the operational level of service, reducing congestion, on existing or future connectors?</p> <p>If a HOV direct connector is feasible after consideration of the above factors, freeway-to-freeway HOV direct</p> |
|--|---|

connector geometric standards, except for 1.5m median shoulder should be used. However, when space is limited and the design exception fact sheet is approved, reducing the ramp geometrics may be justified. HOV connectors may merge or diverge from either the right or left side of the through HOV lanes. See the HDM, Section 302.1. Also, no less than 7.8m between barriers should be provided to retain flexibility for initial or future re-striping to two lanes. HOV direct connectors are often long in length, where future expansion to two lanes also serves to accommodate traffic volume growth and/or transit growth. The typical geometric configurations, cross section and schematic plan, for HOV direct connectors are shown in Figure 3.3 and Figure 3.4, respectively.

Section 3.8 HOV Drop Ramps

HOV ramps that provide ingress and egress between HOV lanes and conventional highways, streets, roads, transit facilities or park and ride facilities are sometimes referred to as HOV drop ramps. As is the case with HOV direct connectors, operational and supporting data are becoming available for planning and designing HOV drop ramps. These guidelines will become more definitive as operational experiences accumulate. It is recommended that the following factors be considered when drop ramps are being considered:

- A. Does the benefit/cost analysis regarding timesavings and safety benefits indicate a reasonable rate of return?
- B. Is there a high concentration of HOV demand due to major attractions such as transit facilities, park and ride facilities, central business districts, or industrial concentrations?
- C. Are HOV volumes using the interchange large enough to have a significant negative impact on the through traffic lanes due to weaving maneuvers?
- D. Does removal of HOV traffic improve the operating level of service for the freeway, the interchange, or the cross streets?

It may be difficult, particularly in retrofit situations, to fit HOV drop ramps into the available space. The typical geometric configurations, cross section and schematic plan, to an overcrossing and an undercrossing are shown in Figures 3.5 and 3.6, respectively.

Section 3.9 Local Obstructions

If the geometric configuration for retrofit HOV facilities proves inadequate at localized obstructions, the geometrics may be further reduced provided the necessary design exception fact sheets are approved. For example, FHWA has allowed three tenths meter (0.3m) median shoulders on a case-by-case basis at local obstructions such as signposts. To retain existing overcrossings, they have also agreed to 3.3m mixed-flow and HOV lanes, no buffer, and 0.6m left and right shoulders.

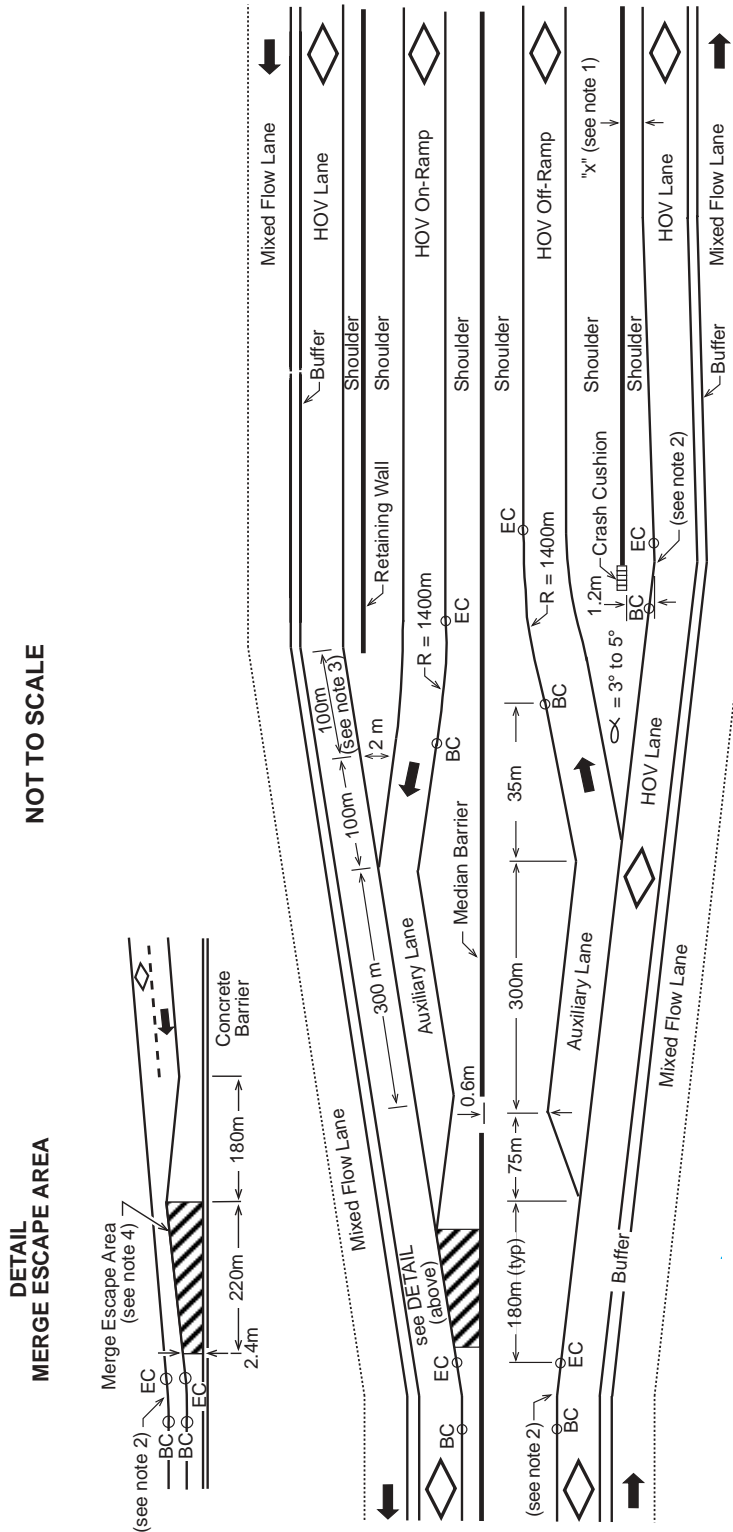
In extreme cases where the cost or impact is great, reducing the right shoulder of ramps or elimination of auxiliary lanes may be considered in order to avoid removal of existing overcrossings. A minimum lateral clearance to the structure or other obstruction should be 0.6m. Benefits of removing the auxiliary lane should be carefully weighed against the adverse operational impacts associated with its removal.

Additional horizontal clearance may be obtained by eliminating the safety shape on the concrete barrier adjacent to structure columns, abutments, or median sign bases as shown in Figure 3.7. The safety shape may be retained at median sign bases by utilizing a steel plate in lieu of concrete.

If the minimum clearance is not achieved by any of the above methods, movement of the columns and replacement or modification of the overcrossing structure should be considered. The length of the new structure should accommodate a full standard facility with the number of lanes indicated in the District's system planning process, included in the Transportation Concept Reports (TCR).

When the approach roadway is widened as part of the HOV project, undercrossing structures should be widened to accommodate the approach roadway.

FIGURE 3.4
TYPICAL HOV DIRECT CONNECTOR
ENTRANCES AND EXITS

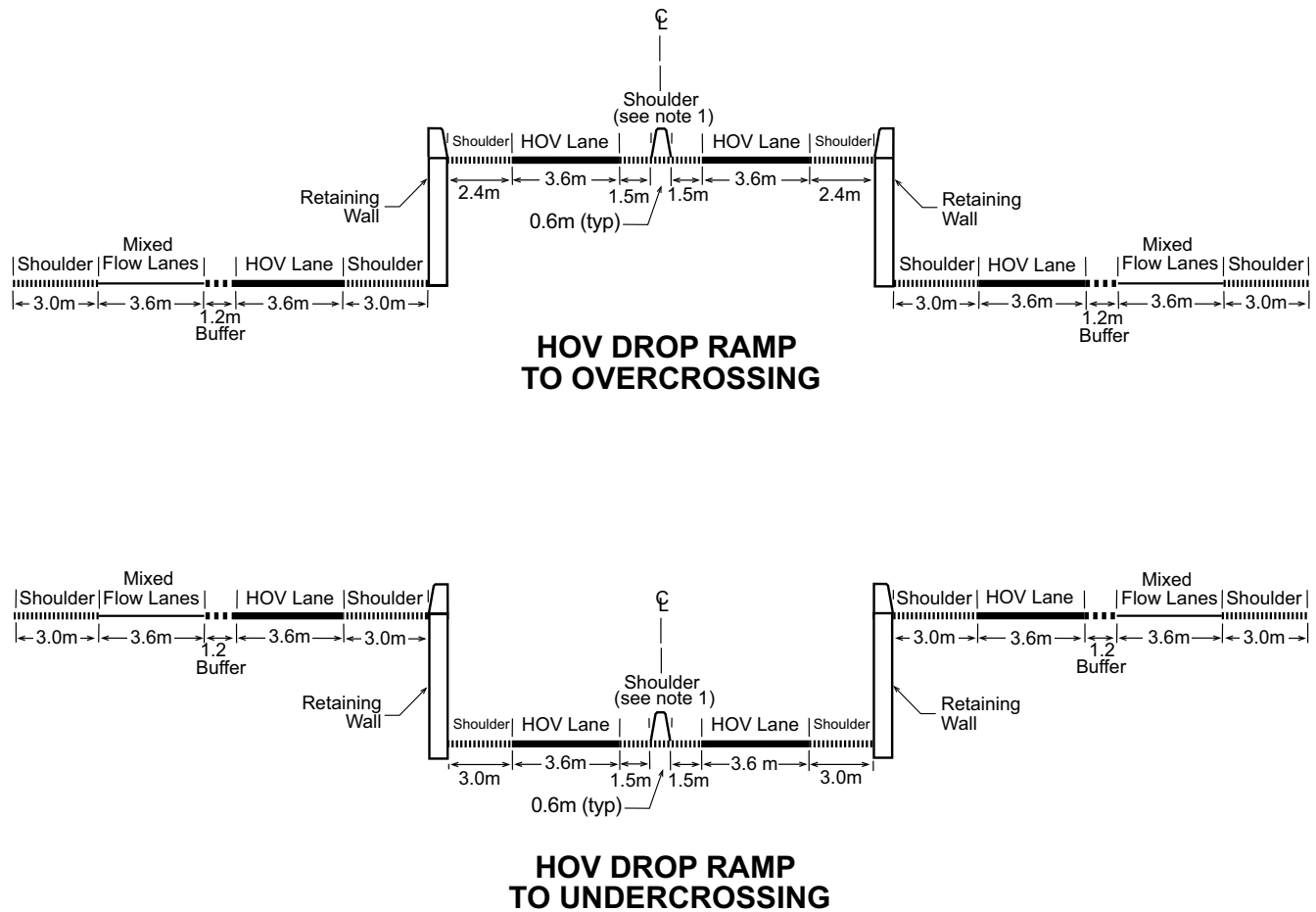


NOTES:

1. Shoulder widths on HOV Direct Connectors shall conform to the Highway Design Manual.
2. $R = 3000m$. Δ is typically less than $01^{\circ}00'00''$. For Δ less than $00^{\circ}30'00''$, a taper may be used in lieu of curve.
3. Entrance profiles should approximately parallel the profile of the freeway for at least 100m prior to the 2m point to provide inter-visibility in merging situations.
4. The Merge Escape Area (Detail) is not required where the left freeway shoulder is 2.4m or greater.

**FIGURE 3.5
TYPICAL CROSS SECTIONS
HOV DROP RAMP TO
OVERCROSSING AND UNDERCROSSING**

NOT TO SCALE

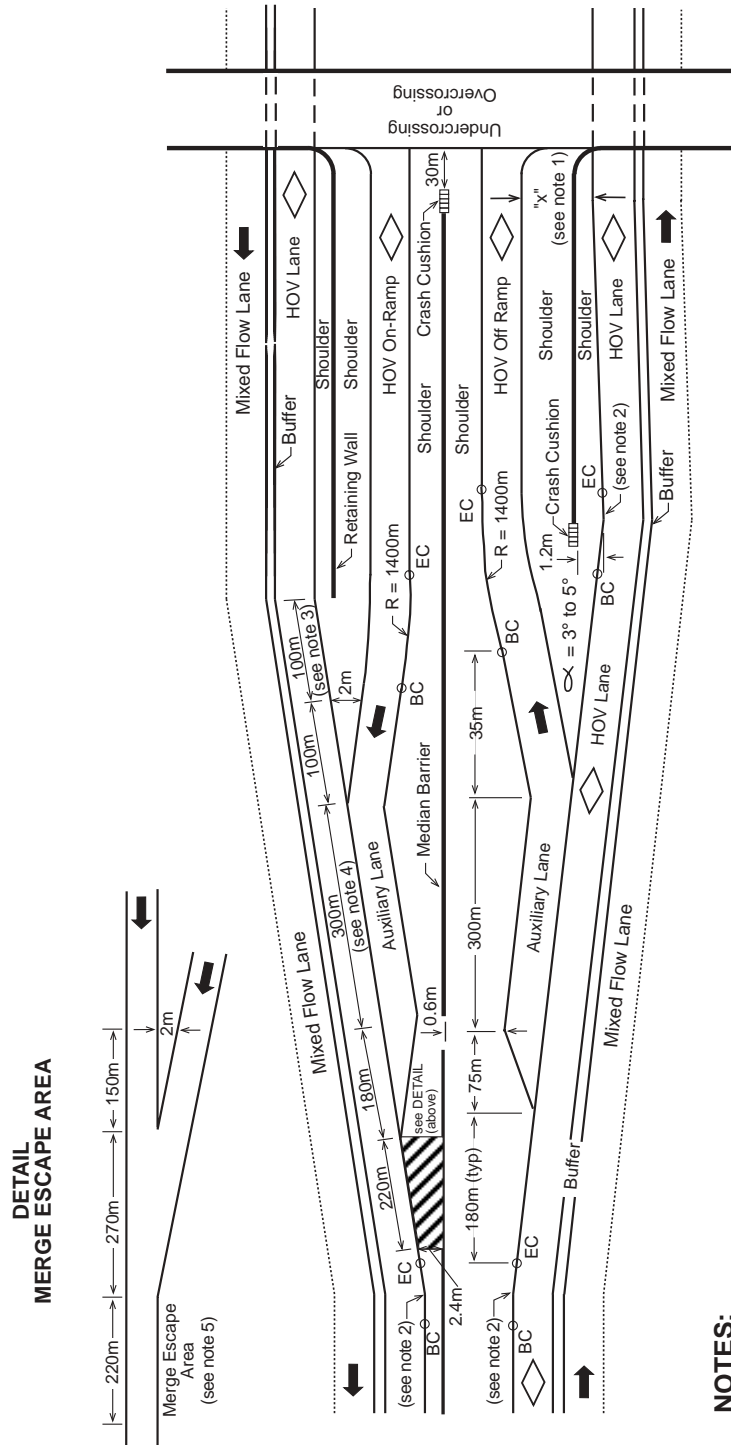


NOTE: Justification for the use of anything less than typical geometrics must be well documented by a sound engineering analysis. Any deviation from these recommendations should be discussed with the FHWA Transportation Engineer, Traffic Operations personnel, from the District and Headquarters, Headquarters' Traffic Liaisons and Headquarters' Design Coordinators.

See Topic 82, Chapter 80 of the HDM.

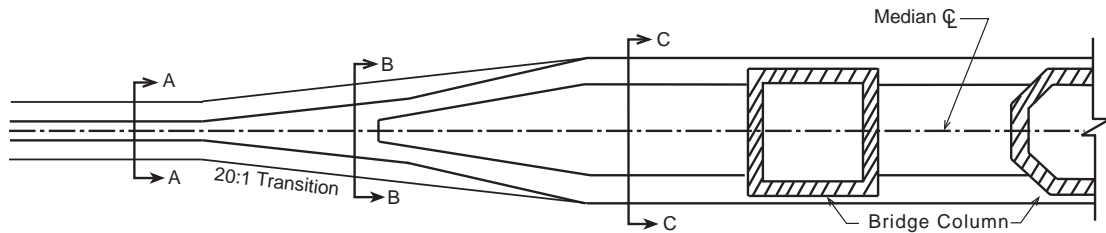


NOT TO SCALE

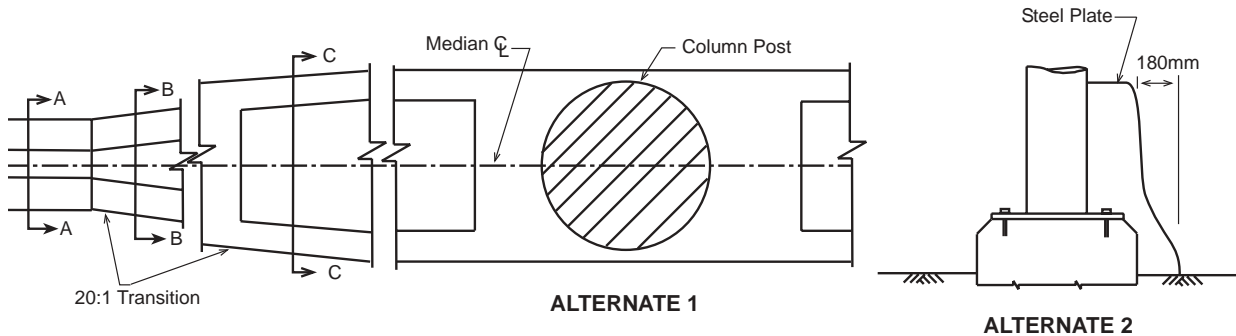


1. Shoulder widths on HOV Drop Ramps shall conform to the Highway Design Manual.
2. $R = 3000m$. Δ is typically less than $0^{\circ}00'00''$. For Δ less than $00^{\circ}30'00''$, a taper may be used in lieu of curve.
3. Entrance profiles should approximately parallel the profile of the freeway for at least 100m prior to the 2m point to provide inter-visibility in merging situations.
4. A 300m long auxiliary lane should be provided, particularly on ascending entrance ramps.
5. The Merge Escape Area (Detail) is not required where the left freeway shoulder is 2.4m or greater.
6. The maximum grade on a descending off-ramp should be 6%.

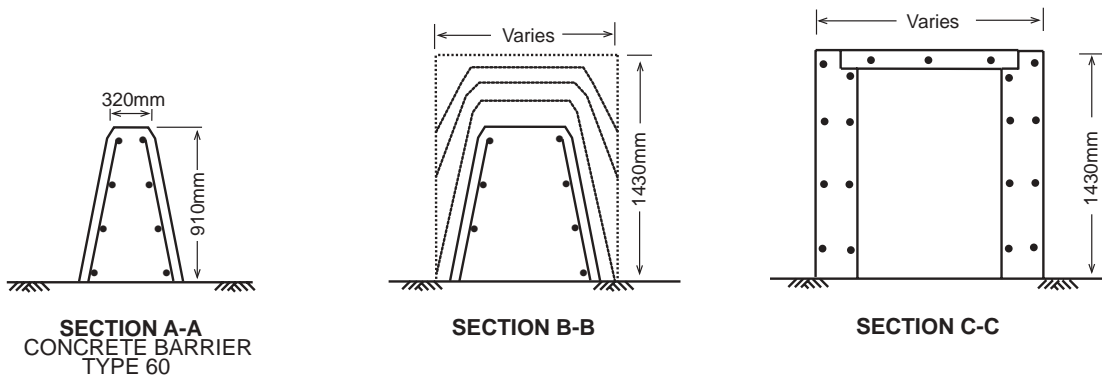
**FIGURE 3.7
MEDIAN BARRIER TRANSITIONS
NOT TO SCALE**



**MEDIAN BARRIER TRANSITION
AT BRIDGE COLUMNS**



**MEDIAN BARRIER TRANSITION AT
SIGN STRUCTURES AND BRIDGE COLUMNS**



NOTE: All structure design details to be provided by the Engineering Service Center, Division of Structures, corresponding to Caltrans Standard Plans.



Section 3.10 Relative Priority of Cross-Sectional Elements

It may be appropriate to consider minor reductions in lane, buffer and shoulder widths at ‘pinch points’ in order to avoid the complete reconstruction of significant roadway elements (i.e. - overcrossing structures). A reduction in standards for cross-sectional elements may be necessary for most retrofit HOV projects. When necessary, any deviation from the HDM mandatory standards must be discussed with Headquarters’ Design Coordinators and, if justified, will require approved design exception fact sheets. For the mixed-flow lanes, outside shoulder widths and the outside lane widths generally should not be altered. When sufficient justification exists, suggested priority for reduction of the cross-sectional elements for the various geometric configurations is outlined below. Any deviation from mandatory standards shall be discussed with the FHWA Transportation Engineer (at, or impacting, interstate freeways), Traffic Operations personnel, from the District and Headquarters, Headquarters’ Traffic Liaisons and Headquarters’ Design Coordinators. See Chapter 80 of the HDM for specific requirements.

1. Two-Way Barrier-Separated HOV Facilities (See Figure 3.1)

- ◆ First, reduce the left HOV shoulder to 0.6m.
- ◆ Second, reduce the HOV lane to 3.3m.

If the above reductions are not sufficient to meet right of way constraints, then buffer-separated or contiguous HOV facilities should be considered.

2. Reversible Barrier-Separated HOV Facilities (See Figure 3.1)

- ◆ First, reduce the 1.5m HOV shoulder to a minimum of 0.6m while maintaining a minimum 3.0m shoulder on the other side.
- ◆ Second, reduce the HOV lanes to a minimum of 3.3m.

- ◆ Third, reduce the mixed-flow left shoulder to a minimum of 2.4m, if the shoulder is structurally adequate.
- ◆ Fourth, reduce the mixed-flow lanes to 3.3m, starting with the left lane and moving to the right as needed. The outside mixed-flow lane should remain at 3.6m unless truck volumes are less than 3%.
- ◆ Fifth, reduce the left shoulder for the mixed-flow lanes to a minimum of 0.6m. Shoulders less than 2.4m but greater than 1.5m are not recommended. Any excess width resulting from a reduction of median shoulder width from 3.0m to 1.5m or less should be used to restore the mixed-flow lane widths to 3.6m starting from the outside and moving to the left.

3. Buffer-Separated HOV Facilities (See Figure 3.2)

- ◆ First, reduce the median shoulders from 4.2m (the width to accommodate continuous enforcement areas) to 3.0m. Any reduction of the median shoulders should be accompanied by the addition of CHP enforcement areas.
- ◆ Second, reduce the buffer to 0.6m.
- ◆ Third, reduce the median shoulders to a minimum of 2.4m.
- ◆ Fourth, reduce the HOV lane to 3.3m.
- ◆ Fifth, reduce the number one mixed-flow lane to 3.3m.
- ◆ Sixth, reduce the remaining mixed-flow lanes to 3.3m, starting with the number two lane and moving to the right as needed. The outside mixed-flow lane should remain at 3.6m unless truck volume is less than 3%.
- ◆ Seventh, reduce the median shoulders to a minimum of 0.6m. Shoulders less than 2.4m but greater than 1.5m are not recommended. Any excess width resulting from a reduction of median shoulder width from 2.4m to 1.5m or less should be used to restore the mixed-flow lane

widths to 3.6m starting from the outside and moving to the left.

The reduction of the median shoulders from 4.2m to either 2.4m or 0.6m should be combined with the construction of enforcement areas.

4. Contiguous HOV Facilities

(See Figure 3.2)

- ◆ First, reduce the median shoulders from 4.2m (the width to accommodate continuous enforcement areas) to 3.0m. Any reduction of the median shoulders should be accompanied by the addition of CHP enforcement areas.

- ◆ Second, reduce the median shoulders to a minimum of 2.4m.

- ◆ Third, reduce the HOV lane to 3.3m.

- ◆ Fourth, reduce the mixed-flow lanes to 3.3m, starting with the left lane and moving to the right as needed. The outside mixed-flow lane should remain at 3.6m unless truck volumes are less than 3%.

- ◆ Fifth, reduce the median shoulders to a minimum of 0.6m. Shoulders less than 2.4m but greater than 1.5m are not recommended. Any excess width resulting from a reduction of median shoulder width from 2.4m to 1.5m or less should be used to restore the mixed-flow lane widths to 3.6m starting from the outside and moving to the left.

Section 3.11 On-Line Bus Facilities

On-line bus station facilities are built within freeway medians providing buses a direct access to a bus loading and unloading stop without exiting the HOV facility. They are normally located at overcrossings or undercrossings to arterial streets at local bus or rail station connections. Regional Transportation Agencies are normally involved in the planning process if on-line bus facilities are to be considered. A typical geometric configuration, layout and cross-section, for an on-line bus station is shown in Figure 3.8.

1. General

The following amenities should be included in the on-line bus station platform design:

- ◆ Facility Covering: Provide shelter to protect patrons from rain and direct sunshine.
- ◆ Seating: A limited amount of seating should be provided on the platform.
- ◆ Transit Information: A provision in the station design should be made for informational kiosks containing maps and schedules of bus lines.

2. Communications

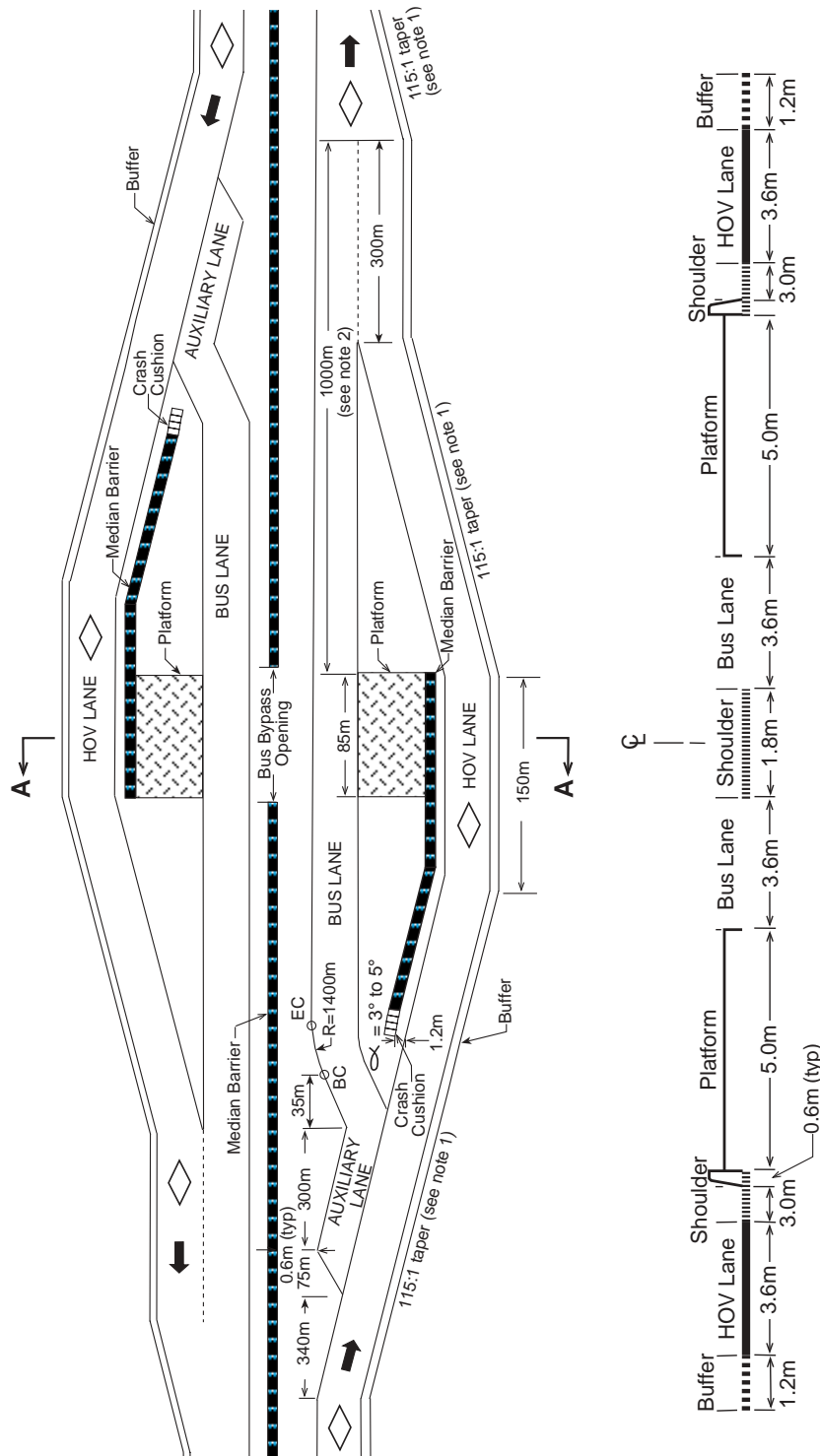
The following communication requirements should be included in the on-line bus station platform design:

- ◆ Hook-ups to telecommunications and data sources for security and data collection purposes.
- ◆ Pay telephones.
- ◆ A closed circuit television security system.
- ◆ A direct line to a dispatcher for emergencies.
- ◆ Direct, on-line transit information.



FIGURE 3.8
TYPICAL LAYOUT AND CROSS SECTION
HOV ON-LINE BUS FACILITIES

NOT TO SCALE



SECTION A-A

NOTES:

1. For 115:1 taper, $\Delta = 00^{\circ}30' 00''$. A curve may be used in lieu of a taper. $R = 3000m$.
 Δ is typically less than $01^{\circ}00' 00''$.
2. 1000m is recommended for bus acceleration.